Instruction Manual

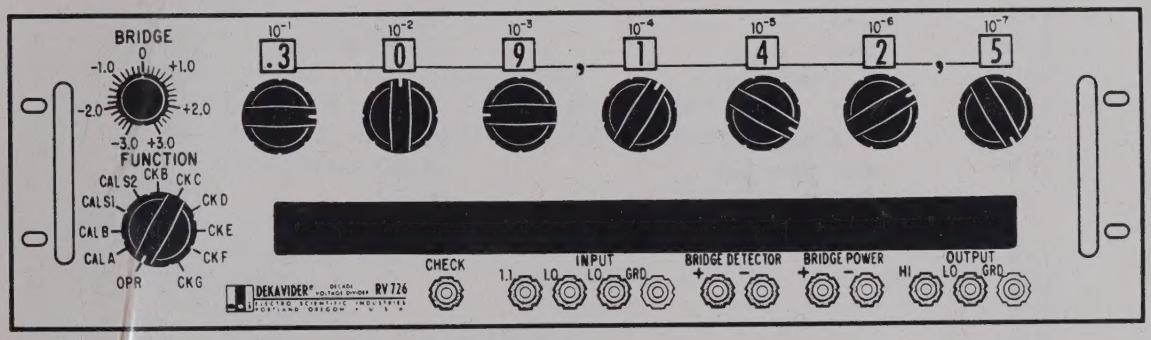
OCTOBER 1969

REPLACES JULY 1969

MODEL RV 726

DEKAVIDER® DECADE VOLTAGE DIVIDER

MICROFICHED



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The following table lists the most recent revision of each page at the present printing:

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DEKAVIDER® Decade Voltage Divider
KELVIN KLAMPS® Four-Terminal Clamps
KELVIN KLIPS® Four-Terminal Clips
PORTAMETRIC® Portable Measuring Instrument
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SECTION I

INTRODUCTION

1.1 DESCRIPTION

ESI Model RV 726 is a modified Kelvin-Varley voltage divider with a built-in ratio bridge for self-calibration. The self-calibration feature allows extremely high linearity without comparison to external standards.

Decade dials indicate the output voltage in proportional parts of the voltage at the 1.0 INPUT terminal. A voltage 1.1 times higher can be connected to the 1.1 INPUT terminal, and the dials will still indicate the voltage in proportional parts as before, but the voltage at the 1.0 INPUT terminal will be 10/11 of the total input voltage. If the higher voltage is used, the divider will over-range to 1.1, allowing full interpolation of voltage.

A simplified schematic diagram of the Kelvin-Varley portion of the circuit is shown in Figure 1-1.

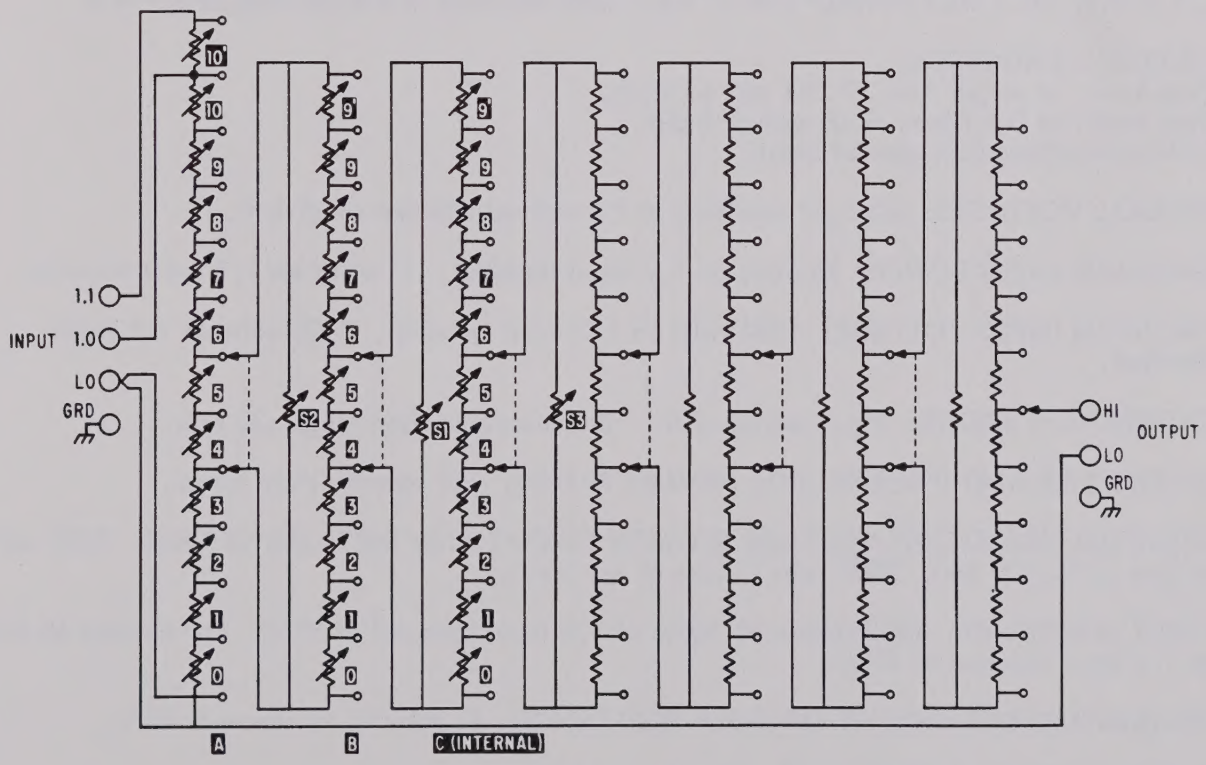

Figure 1-1. Kelvin-Varley Circuit

1.2 SPECIFICATIONS

RATIO RANGE: 0 to 1.0 (1.0 input tap) and 0 to 1.1 (1.1 input tap).

RESOLUTION: 0.1 ppm of input in 7 decades.

ABSOLUTE LINEARITY: ±0.1 ppm of input at dial settings of 1.1 to 0.1.
±0.1 (10 x setting)$^{1/3}$ ppm of input at dial settings of 0.1 to 0.

ABSOLUTE LINEARITY STABILITY: ±1.0 ppm per year of input at dial settings of 1.1 to 0.1.
±1.0 (10 x setting)$^{2/3}$ ppm per year of input at dial settings of 0.1 to 0.

TEMPERATURE COEFFICIENT OF LINEARITY: ±0.1 ppm of input/°C maximum at dial settings of 1.1 to 0.1.

SHORT-TERM LINEARITY STABILITY: In standards-laboratory environment (temperature maintained within ±2°C) and with applied voltage not greater than 100 volts, stability of linearity is 0.1 ppm 30 days.

POWER COEFFICIENT OF LINEARITY: ±0.2 ppm of input/watt maximum at dial settings of 1.1 to 0.1; ±0.2 (10 x setting)^2 ppm of input/watt maximum at dial settings of 0.1 to 0.

MAXIMUM END ERRORS
Zero error, at output low: 0.004 ppm of input.
Zero error, at input low: 0.05 ppm of input.
Full-scale error: 0.05 ppm of input.

THERMAL VOLTAGES: ±0.5 μV maximum at thermal equilibrium conditions.

MAXIMUM INPUT POWER: 10 watts on 1.0 input terminal. 11 watts on 1.1 input terminal.

MAXIMUM INPUT VOLTAGE: 1000 volts on 1.0 input terminal. 1100 volts on 1.1 input terminal.

CALIBRATION BRIDGE: Input voltage 20V. Maximum deviation range ±30 ppm.

DIVIDER STEP AND INTER DECADE TRIMMER RANGE: ±25 ppm minimum range.

MINIMUM BREAKDOWN VOLTAGE BETWEEN CIRCUIT AND INSTRUMENT CASE: 2000 volts to case at 10,000 feet; 2500 volts to case at sea level.

INPUT RESISTANCE: 100 kilohms ±0.005% at 1.0 input terminal at 23°C; 110 kilohms ±0.005% at 1.1 input terminal at 25°C.

TEMPERATURE COEFFICIENT OF INPUT RESISTANCE: ±1 ppm/°C maximum at 23°C.

MAXIMUM OUTPUT RESISTANCE: Less than 66 kilohms.

OPERATING TEMPERATURE RANGE: 0°C to 50°C (32°F to 122°F).

OPERATING HUMIDITY RANGE: 35% to 55% relative humidity.

STORAGE TEMPERATURE RANGE: -55°C to +70°C.

VIBRATION: Capable of withstanding a vibration test with frequency varying from 10 to 55 Hz at total excursion of 0.016 in.; frequency varying uniformly from 10 to 55 Hz and returning to 10 Hz in approximately 5 minutes in each of the three major axis without damage to the instrument or degradation of its performance.

VERTICAL AND LATERAL SHOCK: Capable of withstanding vertical and lateral shock of 15G for 11mS of half-sine-wave shock with no damage or degradation of performance.

TILT DROP: Capable of operating satisfactorily without permanent damage or degradation of accuracy after being subjected to a tilt drop test performed by raising each of the four sides of the unit, using the opposite side as a pivot, at least four inches above the horizontal plane and allowing the unit to drop freely onto a solid surface.

DIMENSIONS: Width 19 in. (43.5 cm), height 5.25 in. (13.3 cm), depth 10.2 in.(26.9 cm).

SECTION II

OPERATION

2.1 CONTROLS AND TERMINALS

Front-panel operating and calibration controls are shown in Figure 2-1.

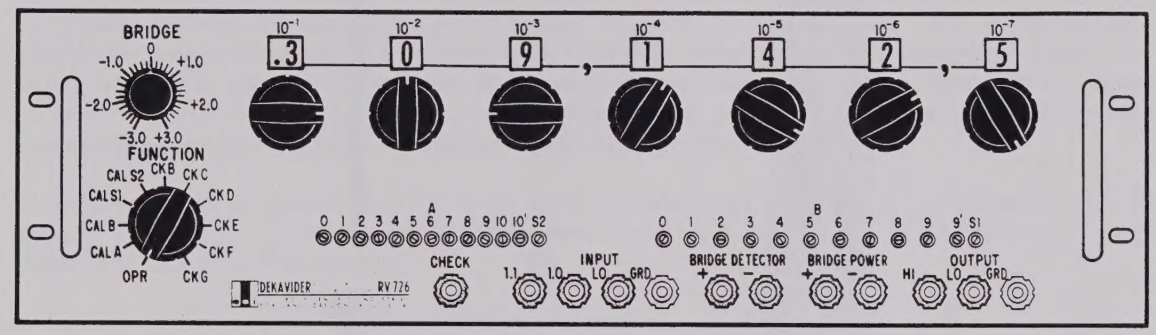

Figure 2-1. Model RV 726

2.1.1 Operating Controls and Terminals

The controls used for normal operation are the decade dials. The in-line reading of the numbers in the windows above the dials is the output voltage in proportional parts of the voltage at the 1.0 INPUT terminal. The first (10^{-1}) dial can go from 0 to 1.0. The latter position is effective only if a voltage is applied to the 1.1 INPUT terminal. (Note that in this case, the voltage divider will connect a voltage that is 10/11 of the input to the 1.0 INPUT terminal and no other voltage is required.)

The terminals used for normal operation are the INPUT and OUTPUT terminals. The INPUT terminals are labeled 1.1, 1.0, LO, and GRD. The input to the divider is applied between INPUT 1.1 or 1.0 and LO; the output is taken from the OUTPUT HI and LO terminals.

2.1.2 Front-Panel Calibration Controls

The front-panel calibration controls comprise the BRIDGE control, the FUNCTION switch and the trimmer adjustments. The FUNCTION switch selects the internal connection for calibration steps. The BRIDGE control is used to compare internal resistors to an internal resistance standard. The trimmer adjustments allow the first two decades to be adjusted for extremely high linearity.

2.1.3 Internal Calibration Controls

Internal calibration controls (Figure 2-2) consist of the internal function switch and the trimmer adjustments for the third decade. The internal function switch selects the connection for calibration of the third decade in the same way that the front-panel FUNCTION switch does. The internal trimmer adjustments allow the third decade to be adjusted as are the first two.

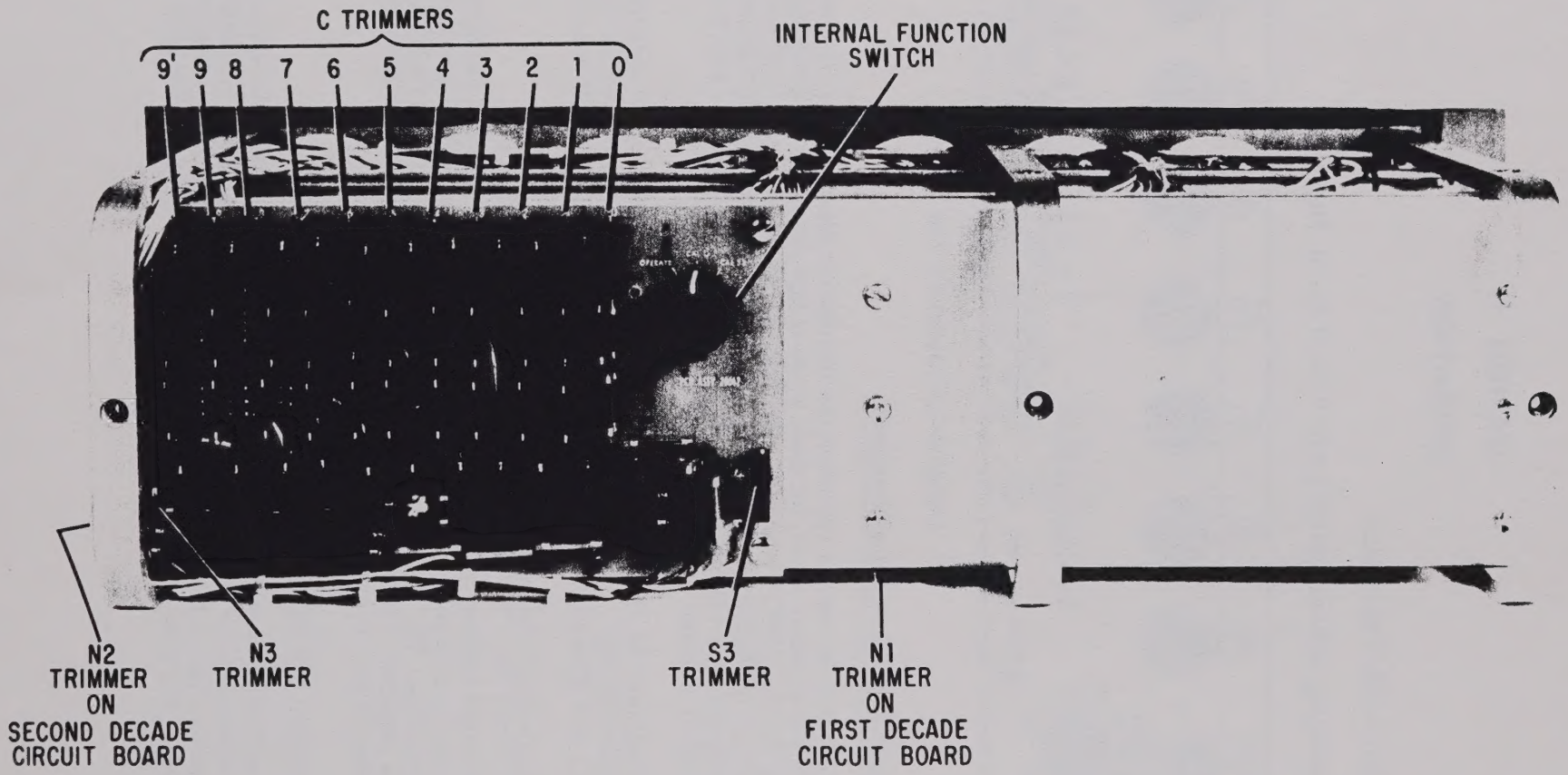
C TRIMMERS
9' 9 8 7 6 5 4 3 2 1 0
INTERNAL FUNCTION SWITCH
N2 TRIMMER ON SECOND DECADE CIRCUIT BOARD
N3 TRIMMER
S3 TRIMMER
N1 TRIMMER ON FIRST DECADE CIRCUIT BOARD

Figure 2-2. Internal Controls

2.2 AIDS TO OPERATION

The input voltage to a voltage divider may be either regulated or not, depending on the application. An unregulated voltage is usually used for comparison between dividers. A highly regulated voltage is used with voltage dividers for voltage measurements.

2.2.1 Divider Comparison

A typical voltage divider comparison circuit is shown in Figure 2-3. The power source should be power-limited to a maximum of 1 watt in order to prevent damage. Under normal conditions, the specified maximum input voltage will not damage the instrument. However, *if input voltage is not power- or current-limited, it is possible, with certain settings and connections, to draw excessive current and damage the instrument.*

A simple means of power limiting is to insert a resistor of value $R = E^2/4$ in series with the supply voltage E. A simple means of current limiting is to insert a 1/32 ampere (or smaller) fuse in series with the output.

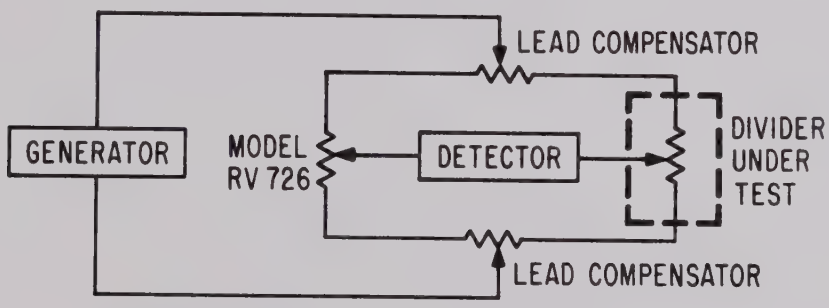

Figure 2-3. Divider Comparison

2.2.2 Precision Voltage Measurement

For simplicity, the voltage connected to the INPUT terminals for precision voltage measurement is usually 0.1, 1, 10, 100, or 1000 volts connected to the 1.0 INPUT terminal or 0.11, 1.1, 11, 110, or 1100 volts connected to the 1.1 INPUT terminal. With these voltages, the output (unless loaded) is direct reading in volts times a power of 10. Typical voltage measurement circuits are shown in Figure 2-4.

A Kelvin-Varley voltage divider is intended to be used in potentiometric applications, where there is negligible current drawn. If a current is drawn through the OUTPUT terminals, there will be a linearity error. With high impedance detectors and balanced voltages, this error is negligible.

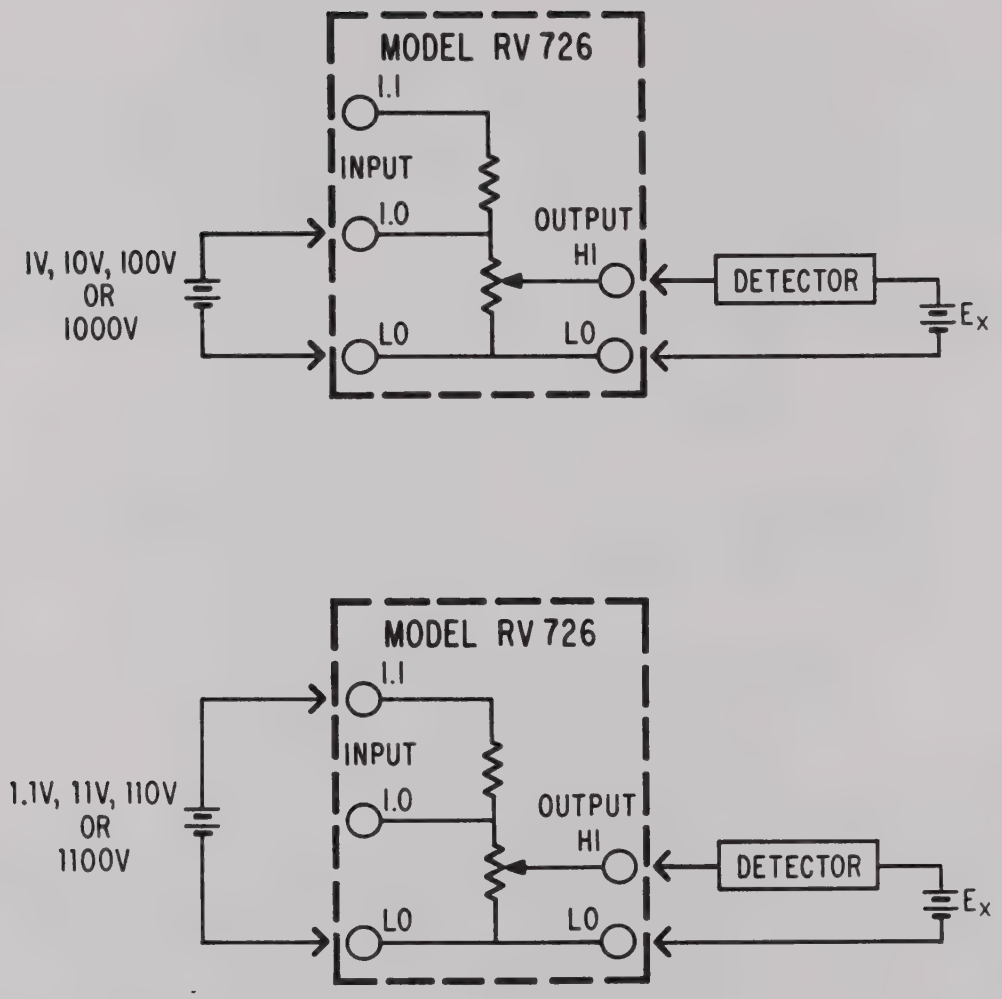

Figure 2-4. Voltage Measurement

SECTION III

ALIGNMENT

3.1 EQUIPMENT REQUIRED

Requirements for Alignment

1. DC Generator

   Output Voltage: 10 to 20 volts (no accuracy requirement).

   Isolation: $10^{12}\Omega$ minimum resistance to ground.

   Power limit: 1 watt

2. DC Detector

   Minimum Detectable Signal: $1\mu V$

   Minimum Input Resistance: $10k\Omega$ (lower resistance requires lower minimum detectable signal)

Recommended Equipment: (1 and 2) ESI Model 801 DC Generator-Detector

3.2 ALIGNMENT

3.2.1 Preliminary

1. Connect Generator-Detector to BRIDGE POWER and DETECTOR binding posts as shown in Figure 3-1.
2. Disconnect any other voltage source from INPUT terminals so that no damage can result from an inadvertant missetting of a switch.
3. Set generator for 10- to 20-volt operation, but do not turn on generator OUTPUT.
4. Set BRIDGE control to 0. (If any trimmer does not have sufficient range, see NOTE, Section 3.2.2.)
5. If adjustments are to be made to the third-decade trimmers, remove the instrument dust cover for access to them.

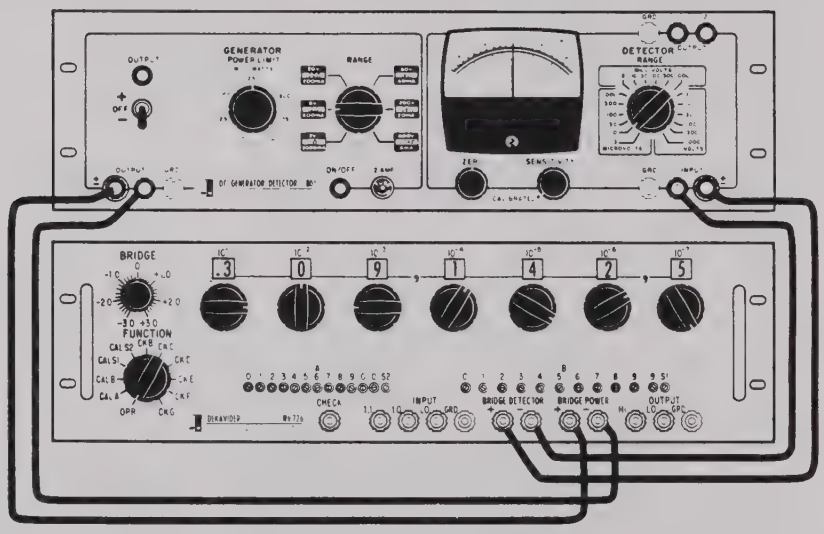

Figure 3-1. Connections for Alignment

3.2.2 Explanation

This procedure is for adjustment of trimmers on the front panel (and inside the instrument if required) in this order:

1. A trimmers 0 through 10 (not 10').
2. B trimmers 0 through 9 (not 9').
3. (This may be omitted) C trimmers 0 through 9 (not 9').
4. (This may be omitted) C trimmer S3.
5. (This may be omitted) C trimmer 9'.
6. B trimmer S1.
7. B trimmer 9'.
8. A trimmer S2.
9. A trimmer 10'.

In the first three steps, the internal bridge is connected (with the FUNCTION switch) as shown in Figure 3-2. In this configuration, the resistors of each decade are compared to a standard resistor (N1 for the first decade, N2 for the second, etc). This allows the resistors in each decade to be adjusted to the same resistance.

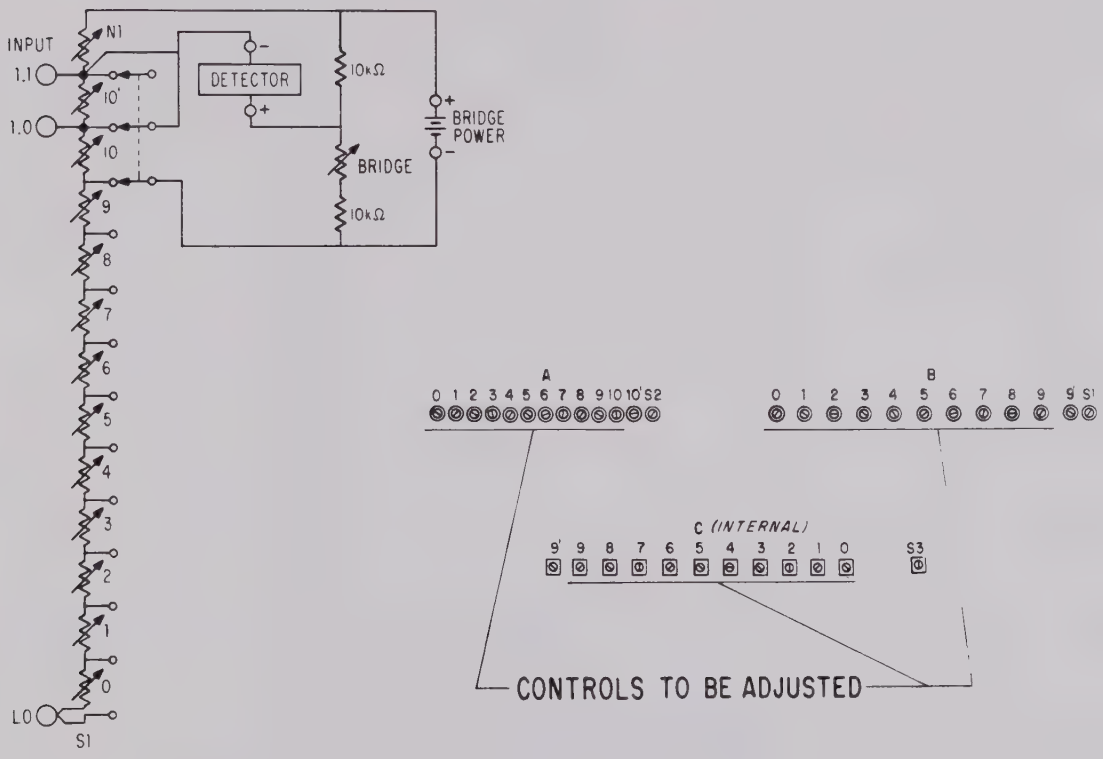

Figure 3-2. Simplified Schematic of CAL A Calibration (B and C Similar)

In steps 4 through 9, the internal bridge is connected as shown in Figure 3-3. In this configuration, the shunting resistors, S1, S2, and S3 can be adjusted so that the parallel combination of the shunt and two step resistors is equal to the resistance of the other step resistors. This configuration also allows adjustment of the upper-end resistor, 10' on decade A, 9' on decades B and C.

NOTE: *The BRIDGE control and N1, N2, or N3 shift the nominal resistance value for the bridge against which the step resistors are trimmed. Any combination of adjustments to these controls which permits all steps in any one decade to be trimmed is valid. Adjustment of BRIDGE control or N or both may be necessary. Each decade must be consistent within itself. The shunts S1, S2, and S3 then make each decade consistent with the whole of the instrument.*

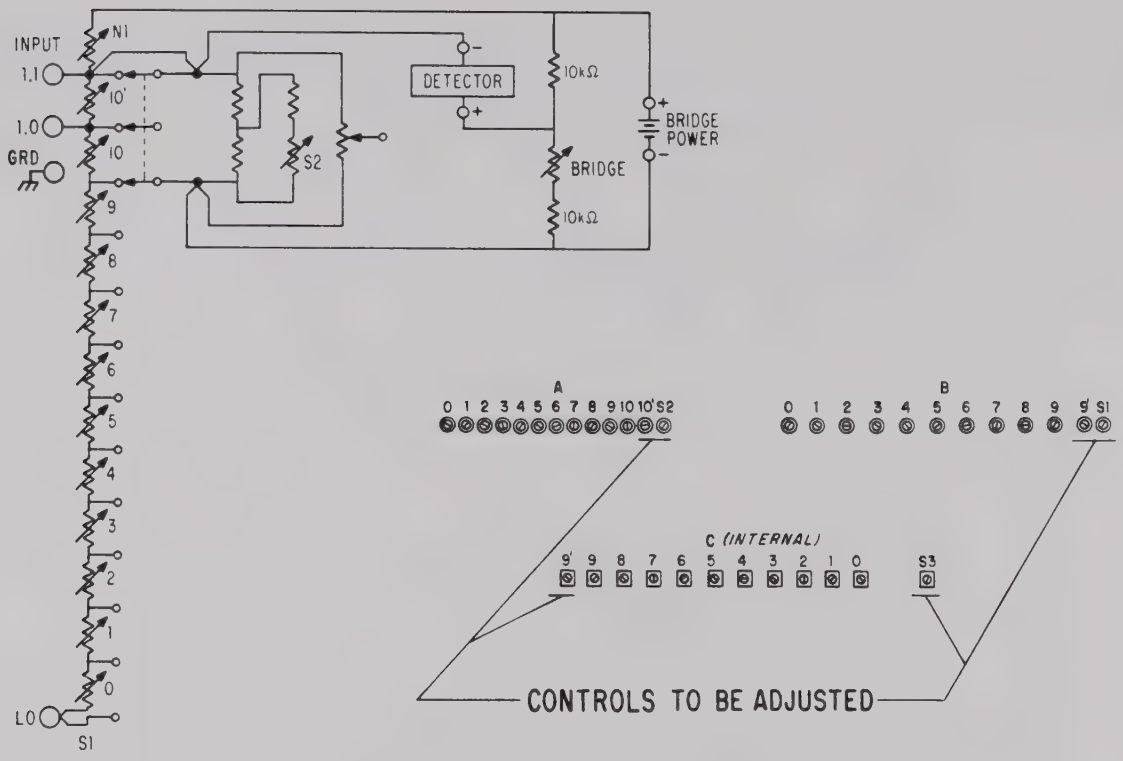

Figure 3-3. Simplified Schematic of 10'A Calibration (S1, S2, S3, 9'B and 9'C Similar)

3.2.3 Decade Trimmer Adjustment

1. Set FUNCTION switch to CAL A.
2. Set the decade to be calibrated to 0. For CAL A, this is the first (10^{-1}) decade, for CAL B, the second (10^{-2}) and for CAL C, the third (10^{-3}).
3. Adjust detector ZERO control for null with detector at highest sensitivity and generator OFF.
4. Set detector RANGE switch to 300 MICROVOLTS. Turn on generator OUTPUT.
5. Set detector SENSITIVITY control to CALIBRATED. Reduce detector RANGE control for a deflection of 1/4 to full scale on one side of zero.
6. Adjust A trimmer 0 for null on the detector. In crease sensitivity on detector RANGE switch and readjust the trimmer until it is nulled on the highest sensitivity range.
7. Turn generator OFF and check the detector ZERO. If the ZERO needs readjustment, adjust it and then repeat step 6.
8. Repeat steps 2 through 7 with the decade set to each of its positions, adjusting in step 6 the trimmer corresponding to the decade setting.
9. Repeat steps 2 through 8 with the FUNCTION switch set to CAL B, adjusting in step 6 the B trimmer corresponding to the decade setting.

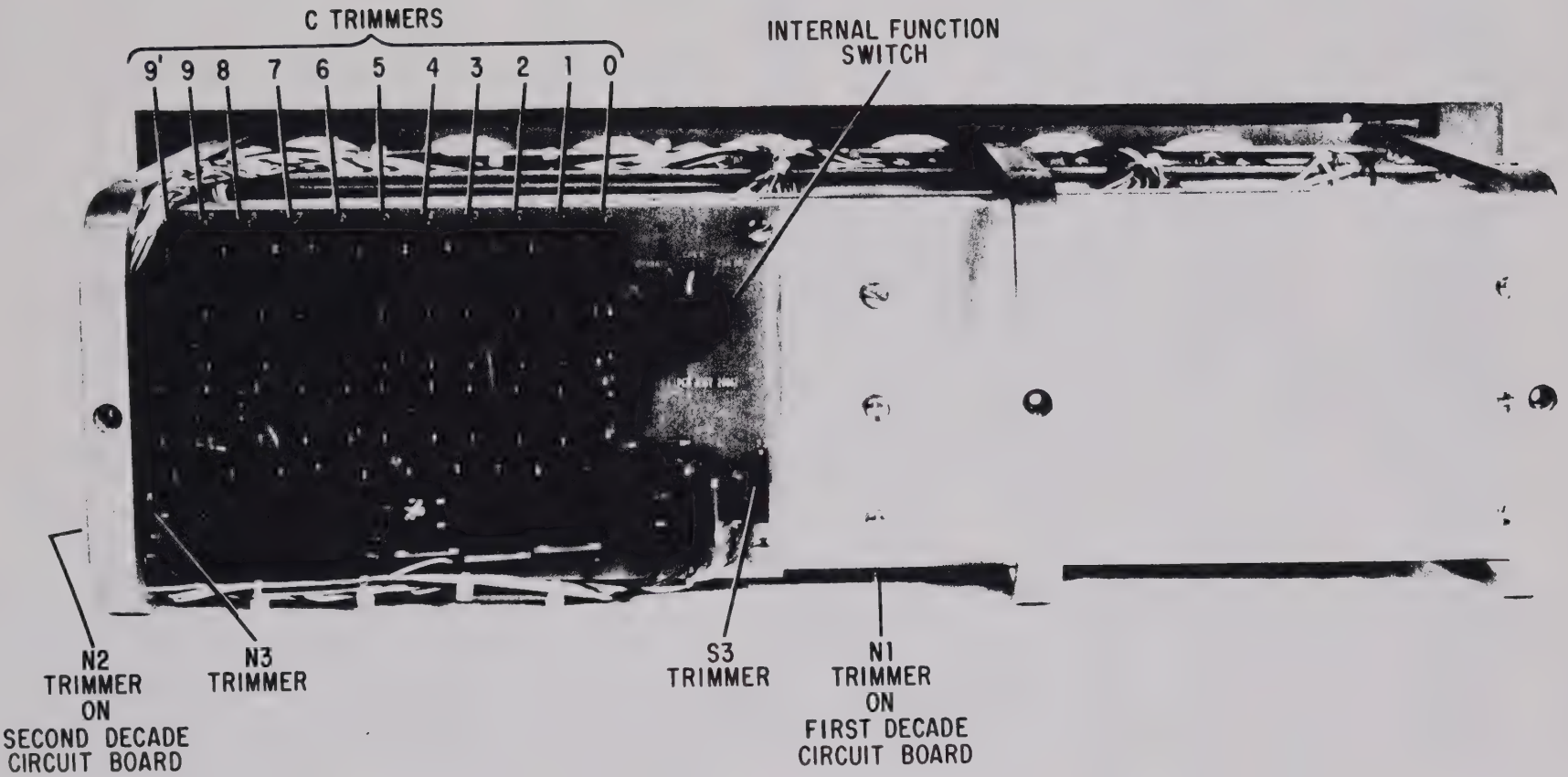
C TRIMMERS
9' 9 8 7 6 5 4 3 2 1 0
INTERNAL FUNCTION SWITCH
N2 TRIMMER ON SECOND DECADE CIRCUIT BOARD
N3 TRIMMER
S3 TRIMMER
N1 TRIMMER ON FIRST DECADE CIRCUIT BOARD

Figure 3-4. Internal Controls

10. (Omit this step if no adjustments are to be made to the third-decade trimmers.) Set external FUNCTION switch to OPR (operate). Set the internal function switch (Figure 3-4) to CAL C and repeat steps 2 through 8, adjusting in step 6 the internal (C) trimmer corresponding to the decade setting.

3.2.4 Shunt, 9' and 10' Trimmer Adjustments

Perform the following steps for the first three decades.

For shunt adjustments the order must be third (10^{-3}), second (10^{-2}), and first (10^{-1}) decade. The third decade may be omitted, but if it is adjusted, it must be done first.

For the 9' and 10' adjustments, the third decade (C9') may be omitted if no other adjustments are made to it.

1. (S3) Set the first three decades to 0.
2. Set internal function switch to CAL S3 and set external FUNCTION switch to OPR (operate).
3. Adjust C trimmer S3 for null on the detector.
4. (C9') Set the first decade to 1.0, the second two decades to 9.
5. Adjust detector ZERO control for null with detector at highest sensitivity and generator OFF.
6. Set detector RANGE switch to 300 MICROVOLTS. Turn on generator OUTPUT and adjust detector RANGE switch for minimum noticeable deflection of the meter.
7. Set detector SENSITIVITY control to CALIBRATED. Reduce detector RANGE control for a deflection of 1/4 to full scale on one side of zero.
8. Adjust appropriate trimmer (C9', B9' or A10') for null on the detector. Increase sensitivity on the detector RANGE switch.
9. Turn generator OFF and check detector ZERO. If the ZERO needs adjustment, adjust it and then repeat step 9.
10. (S1) Set the first three decades to 0.
11. Set internal function switch to OPERATE. (If no adjustments were made to third decade and the outer cover had not been removed, the switch should already be in OPERATE position.)
12. Set external FUNCTION switch to CAL S1.
13. Adjust B trimmer S1 for null on the detector.
14. (B9') Repeat steps 4 through 9, adjusting B trimmer 9'.
15. (S2) Set the first three decades to 0.
16. Set external FUNCTION switch to CAL S2.
17. Adjust A trimmer S2 for null on the detector.
18. (A10') Repeat steps 4 through 9, adjusting A trimmer 10'.

SECTION IV
CALIBRATION

4.1 EQUIPMENT REQUIRED

Requirements for Calibration Test

1. DC Generator (same as for alignment)
2. DC Detector (same as for alignment)
3. Lead Compensator
   Lead Resistance Range: 0 to 150mΩ at each end of each divider
   Resolution of Resistance Compensation: 0.1mΩ
   Ratio between Total Resistance of dividers: 1:1 to 40:1
4. Resistance Transfer Standard
   Description: 11 (or 12) 10kΩ resistors in series
   Accuracy: ±50 ppm, matched to ±10 ppm

Recommended Equipment: (1 and 2) same as for alignment
(3) ESI Model LC875B Lead Compensator

4.2 CALIBRATION TEST

4.2.1 Preliminary

1. Disconnect any voltage source from INPUT terminals, and any connection to OUTPUT terminals.
2. Connect Generator-Detector, Lead Compensator, and Transfer Standard to Model RV 726 Divider as shown in Figure 4-1.

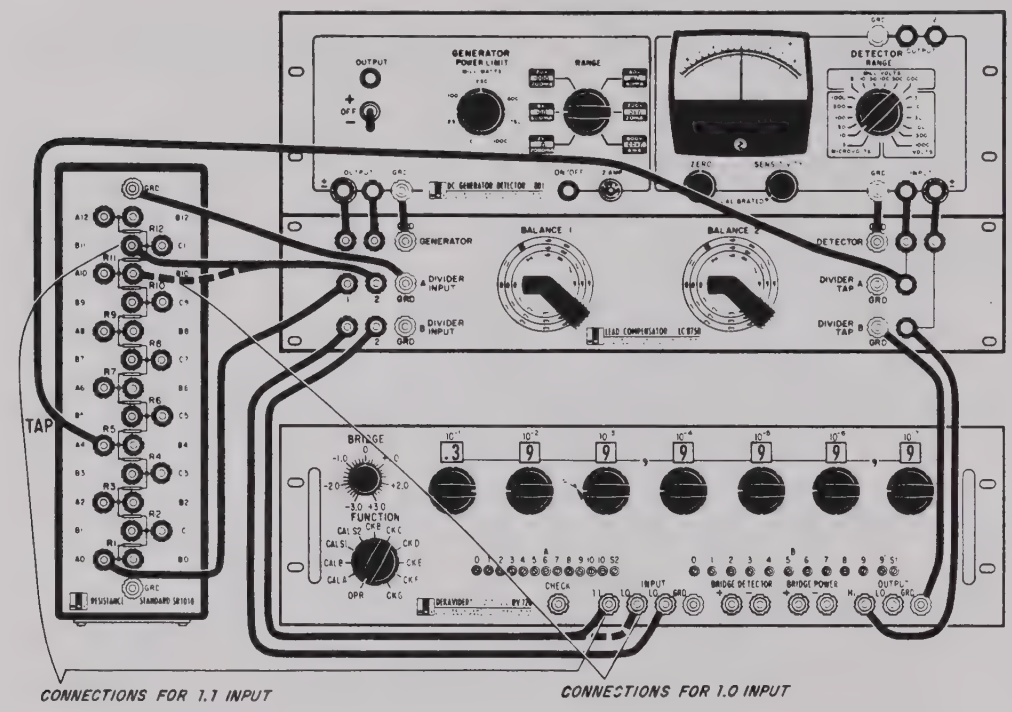

Figure 4-1. Calibration Test A Connections

4.2.2 Transfer Standard Calibration

If it has not been done already, intercompare the resistors of the transfer standard in order to find the linearity deviation. The linearity deviation (L) for 10 resistors is given by the formula:

$$L = \frac{1}{10} \sum_{n=1}^{S} (d_n - D_{10})$$

where d_n is the measured deviation of the nth resistor and D_{10} is the average deviation of the ten resistors. Figure 4-2 shows how these calculations can be developed from the calibration of the transfer standard. This formula is used for all cases where the input must be divided by 10. Substitute 11 for 10 in this formula in those cases in which the input is divided by 11, as it is in those tests of the first decade that use the 1.1 input.

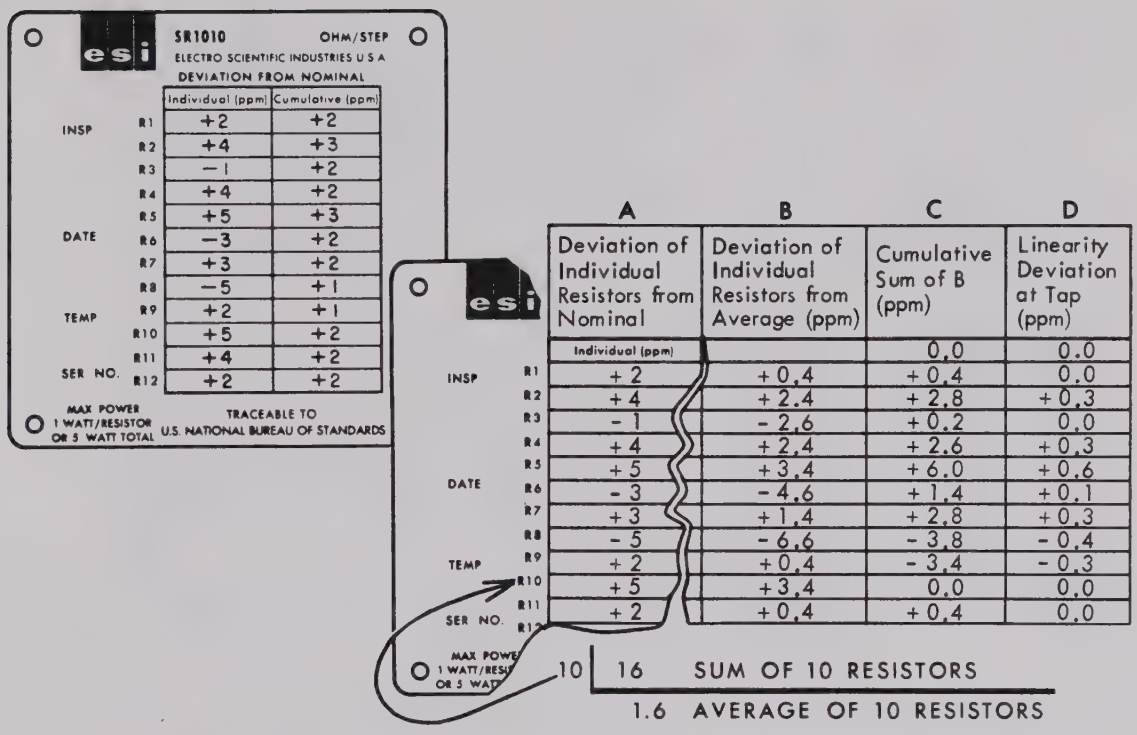
esi
SR1010 OHM/STEP
ELECTRO SCIENTIFIC INDUSTRIES U S A
DEVIATION FROM NOMINAL
Individual (ppm) Cumulative (ppm)
INSP R1 +2 +2
R2 +4 +3
R3 −1 +2
R4 +4 +2
R5 +5 +3
DATE R6 −3 +2
R7 +3 +2
R8 −5 +1
TEMP R9 +2 +1
R10 +5 +2
R11 +4 +2
SER NO. R12 +2 +2
MAX POWER 1 WATT/RESISTOR OR 5 WATT TOTAL
TRACEABLE TO U.S. NATIONAL BUREAU OF STANDARDS
A
Deviation of Individual Resistors from Nominal
B
Deviation of Individual Resistors from Average (ppm)
C
Cumulative Sum of B (ppm)
D
Linearity Deviation at Tap (ppm)
Individual (ppm)
0,0 0.0
+ 2 + 0,4 + 0,4 0,0
+ 4 + 2,4 + 2,8 + 0,3
- 1 - 2,6 + 0,2 0,0
+ 4 + 2,4 + 2,6 + 0,3
+ 5 + 3,4 + 6,0 + 0,6
- 3 - 4,6 + 1,4 + 0,1
+ 3 + 1,4 + 2,8 + 0,3
- 5 - 6,6 - 3,8 - 0,4
+ 2 + 0,4 - 3,4 - 0,3
+ 5 + 3,4 0,0 0,0
+ 2 + 0,4 + 0,4 0,0
10 16 SUM OF 10 RESISTORS
1.6 AVERAGE OF 10 RESISTORS

Figure 4-2. Linearity Deviation Calibration

4.2.3 Test Procedure

The calibration test procedure is similar for each decade. The differences in procedure for the different decades are noted in the following steps and summarized in Figure 4-4.

1. For the first decade, the instrument should be connected as shown in Figure 4-1. For the other decades, connect as shown in Figure 4-3. Set FUNCTION switch as noted in Figure 4-4.
2. Set generator to the range noted in Figure 4-4, but do not turn on power. Adjust detector ZERO for null on the range noted in Figure 4-4.
3. Set all decade dials to 0 and connect the test lead marked "TAP" in Figures 4-1 and 4-3 to terminal B0 of the transfer standard.
4. Set detector to the 3-volt range and turn on generator.
5. Adjust Lead Compensator BALANCE 1 control for null, increasing sensitivity on detector RANGE switch.
6. Adjust the detector SENSITIVITY for 100 microvolts per ppm for the first dial, 20 microvolts per ppm for the second, and 10 microvolts per ppm for the other dials.

   NOTE: This adjustment must be made for each step of each decade. Perform it as follows:

   a. With the divider set properly and the Lead Compensator nearly balanced, adjust generator power so that a change of one step in the 10^{-7} dial causes a change in detector voltage as shown in Figure 4-4. Use detector sensitivity adjustment for fine control if needed. It is more important to have the proper meter deflection than the exact voltage.

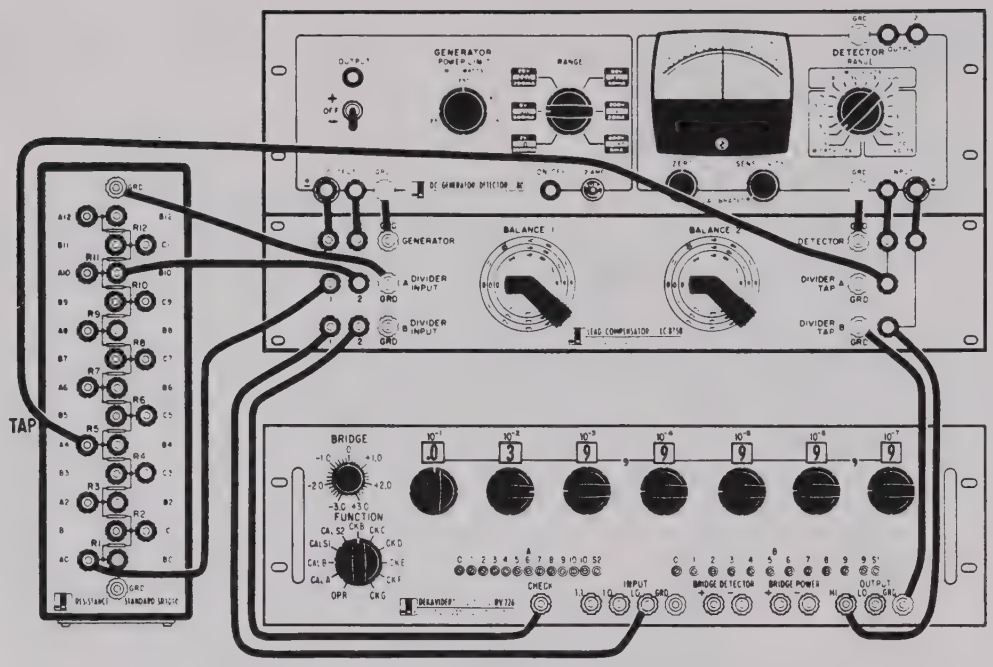

Figure 4-3. Calibration Tests B Through G Connection

7. Turn generator OFF. Set dials being tested and all dials to the right of the decade being tested to 9 except the last (10^{-7}) dial, which is set to TEN. Set all dials to the left of the decade being tested to 0.
8. Connect the test lead marked "TAP" in Figures 4-1 and 4-3 to terminal A10 of the transfer standard.
9. Set detector to the 3-volt range and turn on generator.
10. Adjust Lead Compensator BALANCE 2 control for null.
11. Adjust detector SENSITIVITY as in step 6.
12. Repeat steps 4 through 11 until no further adjustment of the Lead Compensator is necessary. (The adjustments interact slightly.)

NOTE: Perform the following steps for each step of each decade:

13. Turn generator OFF and set dial under test and all dials to the right to 0. For succeeding steps of the decade, set that decade dial to the next setting to be tested.
14. Connect the test lead marked "TAP" in Figures 4-1 and 4-3 to a transfer standard terminal that corresponds to the setting of the decade being tested. (B1 or C1 for dial setting 1, A2 or B2 for dial setting 2, and so forth.)
15. Adjust detector ZERO for null on the range noted in Figure 4-4, then set detector to the 1-volt range and turn on generator.
16. Adjust detector SENSITIVITY as in step 6.
17. Record the meter indication converted to parts per million (100 microvolts per ppm for the first decade, 200 microvolts per ppm for the second decade, one millivolt per ppm for the third decade, 10 millivolts per ppm for the fourth decade, 100 millivolts per ppm for the fifth decade, one volt per ppm for the sixth decade and 10 volts per ppm for the seventh decade).

18. Subtract the linearity deviation of the transfer standard to find the linearity deviation of the divider setting. The tolerance is listed in Figure 4-4.

19. Set decade being tested and all decades to right to 9 except for the last (10^{-7}) decade, which is set to TEN.

20. Connect the test lead marked "TAP" to the corresponding point on the transfer standard (A2 or B2 for dial setting 0.199999 (TEN), B3 or C3 for dial setting 0.299999 (TEN) and so forth).

21. Adjust detector SENSITIVITY as in step 6.

22. Record the meter indication converted to parts per million; refer to step 17. As in step 18, subtract the linearity deviation of the transfer standard to find the linearity deviation of the divider setting.

TEST CONDITIONS	DECADE						
	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}
Connection Figure	4-1	4-3	4-3	4-3	4-3	4-3	4-3
Function Switch Setting	OPR	CK B	CK C	CK D	CK E	CK F	CK G
Detector Range	30μV	3μV	30μV	300μV	3mV	30mV	300mV
Generator Voltage (approximate)	100V	20V	10V	10V	10V	10V	10V
Voltage Change per Step of Last Dial (0.1 ppm)	10μV	20μV	100μV	1mV	10mV	100mV	1V
Tolerance (in ppm) for Decade Setting:*							
1	0.1	0.046	0.022	0.010	0.005	0.002	0.001
2	0.1	0.058	0.027	0.013	0.006	0.002	0.001
3	0.1	0.067	0.031	0.014	0.007	0.003	0.001
4	0.1	0.074	0.034	0.016	0.007	0.003	0.002
5	0.1	0.079	0.037	0.017	0.008	0.004	0.002
6	0.1	0.084	0.039	0.018	0.008	0.004	0.002
7	0.1	0.089	0.041	0.019	0.009	0.004	0.002
8	0.1	0.093	0.043	0.020	0.009	0.004	0.002
9	0.1	0.096	0.045	0.021	0.010	0.004	0.002
TEN (1.0)	0.1	0.100	0.046	0.022	0.010	0.005	0.002
(1.1)	0.1						

*Tolerance is the same for the same nominal ratio (e.g. the same for .0100000 and .009999 (TEN) although the settings differ).

Figure 4-4. Test Procedure Summary

4.3 END ERRORS

Determine the end errors for the Model RV 726 as follows;

1. Connect the equipment as shown in Figure 4-5 and adjust the input voltage to 300 volts.
2. Set all dials to 0 and measure the voltage between OUTPUT HI and INPUT LO. This reading is the input low-end error.
3. Connect the equipment as shown in Figure 4-6. With all dials set to zero, measure the voltage between OUTPUT HI and OUTPUT LO. This reading is the compensated common error.

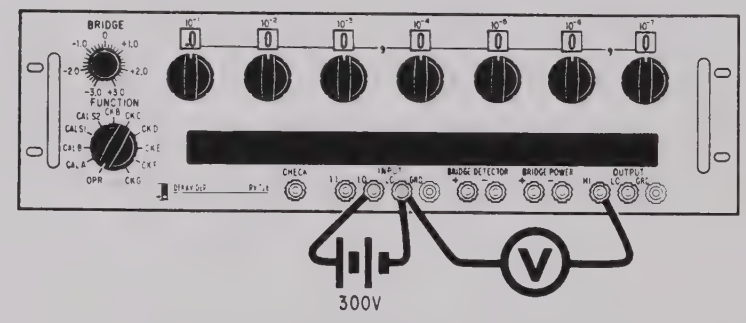

Figure 4-5. Low-End Error

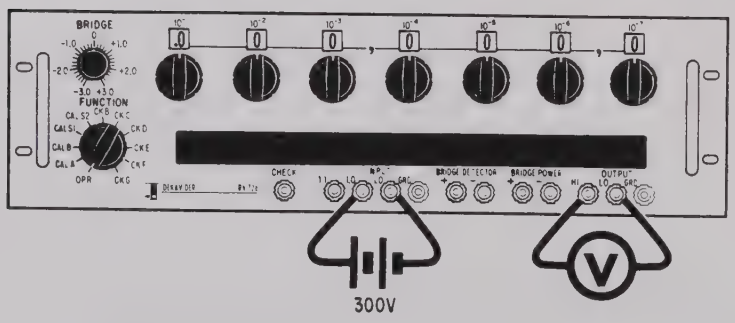

Figure 4-6. Compensated Common Error

4. Connect the equipment as shown in Figure 4-7. Set all dials to full scale, measure the voltage between OUTPUT HI and INPUT 1.1. This reading is the full-scale end error at 1.1 INPUT.

5. Connect equipment as shown in Figure 4-8. Set all dials to full scale except set first dial to .9; measure voltage between OUTPUT HI and INPUT 1.0. This reading is the full-scale end error at 1.0 INPUT.

6. Record the readings. A reading of 3 microvolts is equivalent to 0.01 ppm of input.

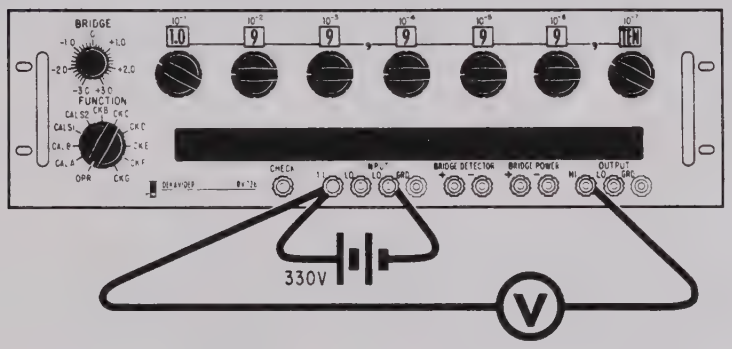

Figure 4-7. Full-Scale End Error at 1.1 INPUT

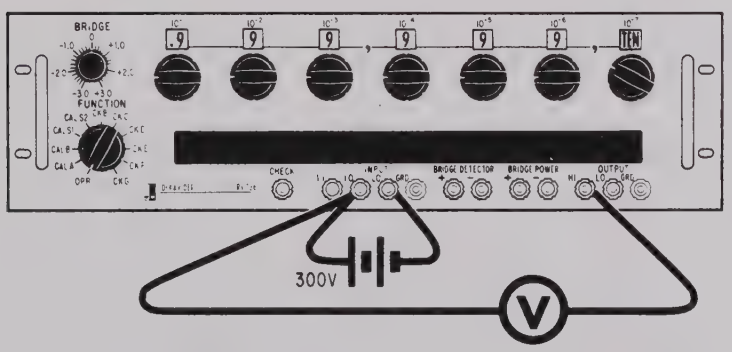

Figure 4-8. Full-Scale End Error at 1.0 INPUT

SECTION V

TROUBLESHOOTING

5.1 TROUBLESHOOTING PROCEDURE

If it is known or suspected that there is trouble in the instrument, first perform the alignment procedure (SECTION III) and the calibration test (SECTION IV). The following table lists the possible symptoms that can occur in the procedure and indicates the probable defective subassembly for each. The table will generally indicate one or two possible causes. In almost all cases, one of the possible items will be a switch. It may be isolated by simple ohmmeter checks. See the schematic diagram, Figure 5-1, for details on switch continuity.

5.2 TROUBLESHOOTING TABLE

The following table lists symptoms that can occur during alignment or calibration test and indicates the probable defective subassemblies. Where more than one cause is listed, the implication is that any one of these things can cause the symptom. In this case, look for more than one symptom. The one subassembly common to all symptoms will nearly always be the defective one.

Symptom	Probable Cause
First Decade	
Linearity test failure	A1 A2
Input open circuited	A1
Alignment Procedure CAL A	
Indicated voltage is far off scale at any setting of the decade	A4 S1 S8
Value cannot be adjusted within tolerance at any setting of the decade	A4 R1
Indicated voltage is far off scale at only one decade setting	A1 A2 S1

Symptom	Probable Cause
Alignment Procedure CAL B	
Indicated voltage is far off scale at any setting of the decade	A3 A4 S2 S8
Value cannot be adjusted within tolerance at any setting of the decade	A3 A4 R1
Indicated voltage is far off scale at only one decade setting	A3 S2
Value cannot be adjusted within tolerance at only one decade setting	A3
Alignment Procedure CAL S1	
Indicated voltage is far off scale at any setting of the decade	A4 S2 S8
Value cannot be adjusted within tolerance at any setting of the decade	A4 R1
Indicated voltage is far off scale at only one decade setting	S2
Alignment Procedure CAL S2	
Indicated voltage is far off scale at any setting of the decade	A2 A4 S1 S8
Value cannot be adjusted within tolerance at any setting of the decade	A2 A4 R1
Indicated voltage is far off scale at only one decade setting	A2 S1
Alignment Procedure CAL C	
Indicated voltage is far off scale at any setting of the decade	A4 S3 S9
Value cannot be adjusted within tolerance at any setting of the decade	A4 R1
Indicated voltage is far off scale at only one decade setting	S3

Symptom	Probable Cause
Alignment Procedure CAL S3	
Indicated voltage is far off scale at any setting of the decade	A4 S3 S9
Value cannot be adjusted within tolerance at any setting of the decade	A4 R1
Indicated voltage is far off scale at only one decade setting	S3
Calibration Test CK B	
Indicated voltage is far off scale at any setting of the decade	S2 S8
Indicated voltage is far off scale at some (not all) settings	S2
Calibration Test CK C	
Indicated voltage is far off scale at any setting of the decade	S3 S8
Indicated voltage is far off scale at some (not all) settings	A4 S3
Calibration Test CK D	
Indicated voltage is far off scale at any setting of the decade	S4 S8
Indicated voltage is far off scale at some (not all) settings	A5
Calibration Test CK E	
Indicated voltage is far off scale at any setting of the decade	S5 S8
Indicated voltage is far off scale at some (not all) settings	A5 S5
Value is out of tolerance during test at some (not all) settings	A5

Symptom	Probable Cause
Calibration Test CK F	
Indicated voltage is far off scale at any setting of the decade	S6 S8
Indicated voltage is far off scale at some (not all) settings	A5 S6
Value is out of tolerance during test at some (not all) settings	A5
Calibration Test CK G	
Indicated voltage is far off scale at any setting of the decade	S7 S8
Indicated voltage is far off scale at some (not all) settings	A5 S7
Value is out of tolerance during test at some (not all) settings	A5

5.3 MECHANICAL TROUBLESHOOTING

1. For easy access to the N1 trimmer, a screwdriver with a 10-inch blade and small diameter is necessary.

2. To replace the BRIDGE control knob, should it be removed for any reason, turn the switch shaft all the way clockwise or counter-clockwise and line up the white line on the knob with both extremes.

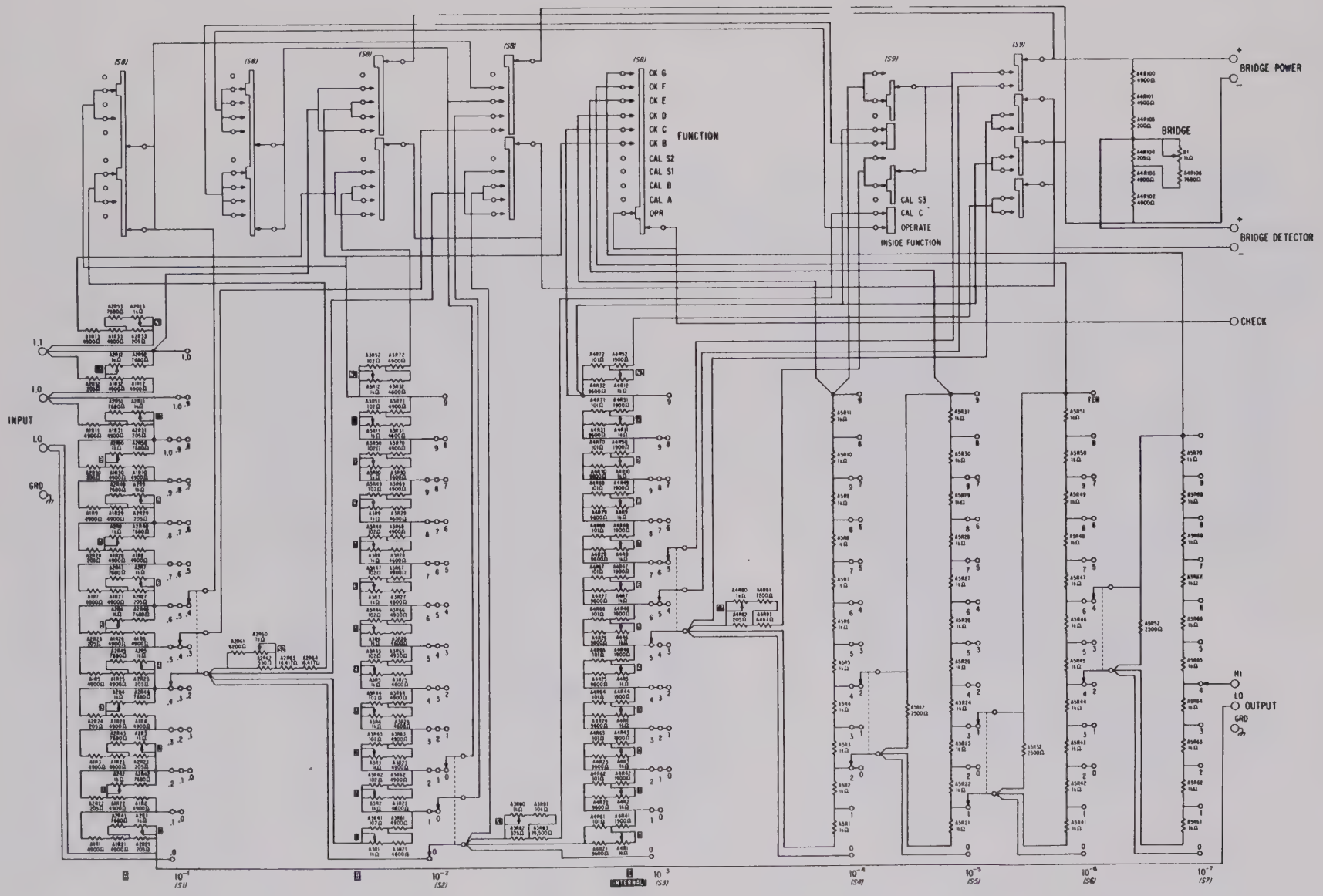

Figure 5-1. Schematic Diagram

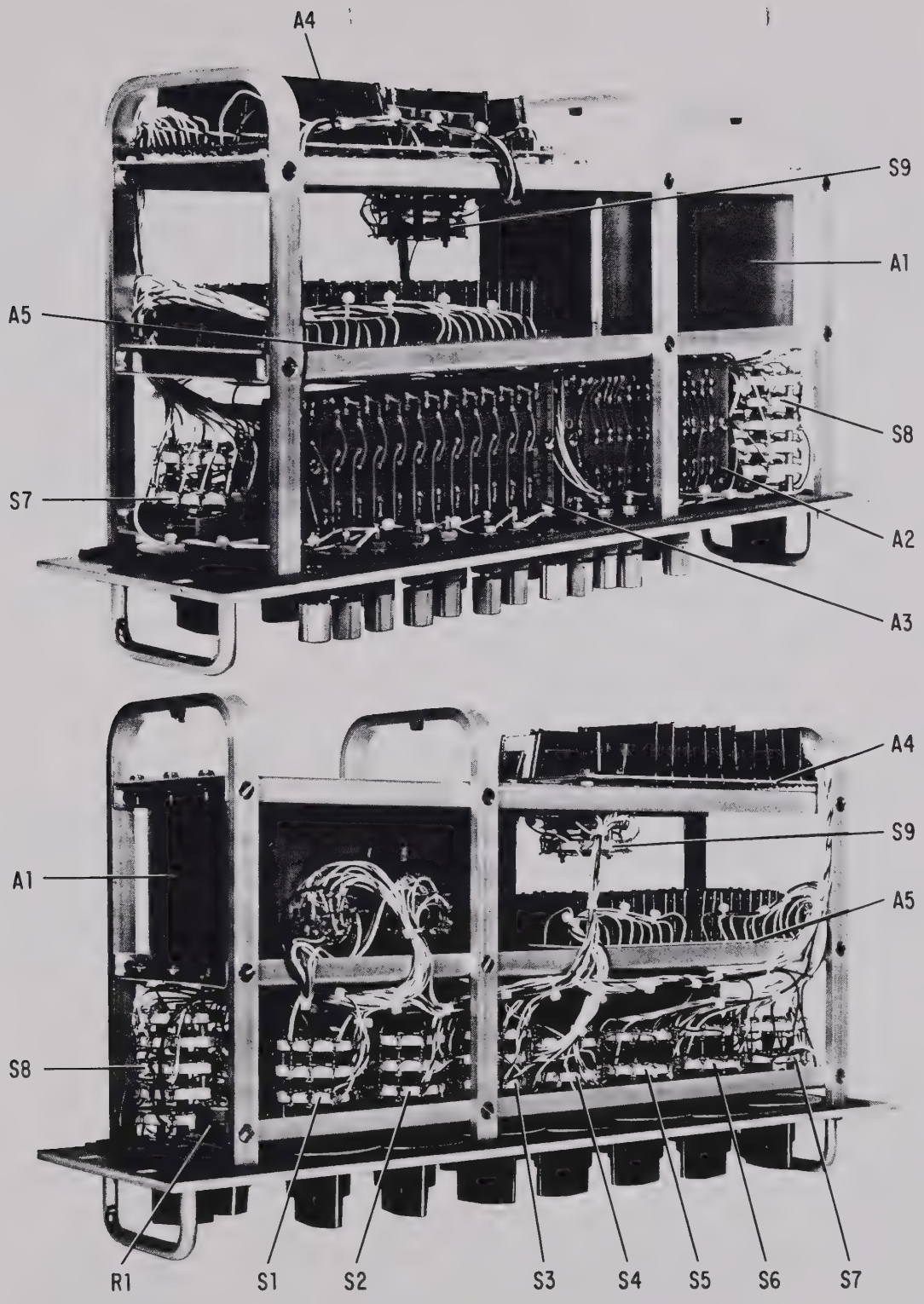

Figure 5-2. Subassembly Locations

5.4 REPLACEMENT PARTS

The following parts are listed in two groups: Those with and those without circuit reference designators. The parts in each group are listed alphabetically by description of part. See Figure 4-2 for location and reference designators. The Federal Code for Manufacturers (FSC) for Electro Scientific Industries, Inc. is 11837. All parts on this list may be obtained from Electro Scientific Industries, Inc. When ordering parts, include the following information:

Model and serial number of the instrument (Model RV 726)

Electro Scientific Industries part number

Circuit reference designator (where applicable)

Description of part

CKT REF	DESCRIPTION	PART NO.	QTY USED
A1	RESISTANCE ASSY, Sealed	20069	1
A2	PRINTED CIRCUIT ASSY, 1st decade	20058	1
A3	PRINTED CIRCUIT ASSY, 2nd decade	20060	1
A4	PRINTED CIRCUIT ASSY, 3rd decade	20062	1
A5	PRINTED CIRCUIT ASSY, 4,5,6,7th decades	20071	1
R1	RHEOSTAT, BRIDGE	18250	1
S1	SWITCH, 1st decade	20054	1
S2 and S3	SWITCH, 2nd and 3rd decades	20055	2
S4 thru S7	SWITCH, 4th thru 7th decades	19540	4
S8	SWITCH, FUNCTION	20056	1
S9	SWITCH, Internal Function	20057	1
	BINDING POST	18945	10
	BINDING POST, GRD	1395	2
	CAP, Binding Post	1172	2
	CAP, Binding Post	1180	
	COVER, Trimmer	19538	1
	DIAL ASSY	7808	3
	DIAL ASSY	7819	1
	DIAL ASSY	8130	1
	DIAL ASSY	8131	2
	KNOB, Large Bar	1266	8
	KNOB, Small Bar	1270	2

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Final calibration of this instrument was performed with reference to the mean values of the ESI reference standards or to ratio devices that were verified at the time and place of use.

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